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ABSTRACT

The data processing activities to support a multimedia course in leadership (see the final reports which summarize the course development project, EM 010 418, EM 010 419, and EM 010 484) are overviewed in this document. A first section describes the type of flexible systems approach used in conjunction with a comprehensive data base and data management system which was adopted. Other sections cover the data base, student data record, a sample module data record, the data management system, evaluation and validation support, course performance items, and the Project Annapolis Systems Configuration. EM 010 420 through EM 010 447 and EM 010 451 through EM 010 512 are related documents. (SH)

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LEADERSHIP MANAGEMENT COURSE
COMPUTER PROGRAMS & SPECIFICATIONS

Contract No. NOO600-68-C-1525

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LEADERSHIP MANAGEMENT COURSE

COMPUTER PROGRAMS & SPECIFICATIONS

Contract No. NOO600-68-C-1525

This document represents the current definition of those data processing activities that will support the multi-media course in Management Psychology at the U.S. Naval Academy. As the document is derived from continuing specification by the course research and development group, components of the data processing systems will also change as course and research requirements dictate.

Project Manager
Leadership Management Course

Westinghouse Learning Corporation
2083 West Street
Annapolis, Maryland 21401

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OVERVIEW

Since thr proposed data processing activities included support for all elements of the project; (administration of the actual course, research and evaluation of materials, and cost and instructional management of the course), the decision was made to concentrate on a flexible systems approach that would allow any alterations and inclusions. The decision was grounded in the belief that a comprehensive data base and a data management system would combine to provide the necessary framework for any task with a minimum of programming. Trial runs for the selected system and data base format have tentatively verified that this approach can work for this contract.

A constraint of the project, furthermore, makes this approach seem more than merely reasonable. That is, the inability of any research activity to precisely define its exact data processing requirements makes specification of the supportive data processing activities difficult. If decisions are premature, the research group finds itself frozen into a system that can restrict the requisite flexibility of research work. If decisions are postponed until the completion of research definition, an intolerable lapse of time can ensue while the programs and operations are designed, coded, and checked out.

Another consideration for data processing planning with these conditions is the decision that moves the analyst to either task oriented applications or to a total system approach. The former is safer and less reprehensible, the latter is chancey, but the payoff more rewarding.

THE DATA BASE

The data base will contain two major files; one, a comprehensive profile of the students in the experimental course, and secondly, complete documentation on all aspects of the course.

The Student File will include:

(1) Background information pertaining to past academic achievement and will be examined for predictive measures.

(2) Scores from standardized tests will be used to attempt to isolate other learner variables.

(3) Academic and Officer Aptitude Records at USNA.

(4) Student Course Performance.

The Course File will include data on all segments and subdivisions of the course including:

(1) Dimensions of media presentation

(2) Characteristics of Instructional Objectives

(3) Test and Test Item Data

(4) Development and Maintenance Costs of Course Materials.

STUDENT DATA RECORD

Definition of the elements of the student data record proceeded after careful analysis of existing records, and selection of appropriate tests to supply data or other learner variables. This base record will be supplemented by a course performance data.

Item	Characters Reserved	Comment
Name	16	USNA records all fit student names into a sixteen character entry using initials when necessary.
Grade	2	While most students will be from the class of 1972, conditions could arise where midshipmen from other classes could be enrolled. Research data should so note.
I.D.	4	The USNA I.D. is standard--sometimes called the Alpha Code for alphabetical sorting.
AGE	2	Will be changed to include month and year or merely date of birth if item is necessary at all.
Verbal SAT	2	
Math SAT	2	
Eng. CEEB	2	
Math CEEB	2	
Recommendation Score	3	USNA weighs recommendations for applicants according to a prescribed scalar value. The number is added into a cumulative total.

Student Data Record

Item	Characters Reserved	Comment
Activity Score	3	
High School Rank in Class	3	
Grade Point Average (QPR)		
68/69	3	
69/70	3	
70/71	3	
Cumulative Point Rating (CPR)		
68/69	3	
69/70	3	
70/71	3	
Aptitude Evaluation Reports (6)		
Attitude	2	
Performance of Duty	2	
Leadership	2	
Bearing and Dress	2	
Growth Potential	2	
Improvement Rate During Period	2	
Comparison Standing with Classmates	2	
Descriptive Terms Abstracted from Remarks Section	30	

Student Data Record

Item	Characters Reserved	Comment
Aptitude Ratings		
1st Term 68-69	9	
2nd Term 68-69	9	
1st Term 69-70	9	
2nd Term 69-70	9	
1st Term 70-71	9	
2nd Term 70-71	9	
Fiedler Leadership Score		These three tests are independent studies by Naval Science staff members. They will be used if data is available.
X Factor	3	
Y Factor	3	
Total Score	4	
Adjective Check List Score		
Percent of Normal Choice	3	
Percent of Deviant Choice	3	
Total	3	
Cornell Word Form Score		
Raw Score	3	
Adjusted Score	3	
Total Score	3	

Student Data Record

Item	Characters Reserved	Comment
Learner Variables		1-3 Digit Fields using scaled values. They will be derived from a WLC questionnaire that will assay these general items.
Entering Content Knowledge	3	
Entering Learning Skills	3	
Entering Knowledge of Presentation Design	3	
Interest	3	
Motivation	3	
Extrinsic Emotions	3	
Non Learning Activities	3	
Attitude Toward Content	3	
Strong Vocational Interest Blank Scores		
Naval Officer	2	
Army Officer	2	
Air Force Officer	2	
Achievement Need	2	Motivation to be successful.

Student Data Record

Item	Characters Reserved	Comment
Masculine, Feminine Scale	2	Measures occupational interests.
Introversion, Extroversion	2	Applicable to occupational, not social style.
Occupational Level	2	Measures prestige content of occupational interests.
Specialization Level	2	Indicates willingness to concentrate in one field of study.
Officer Retention	2	Predicts probability of making the service a career.
Management Effectiveness	2	Measures characteristics that are found in effective civilian managers.

Item	Characters Reserved		Comment/Interpretation
Sixteen Personality Factor Questionnaire (Forms A and B)			
Factor	A	B	
A	3	3	Reserved vs Outgoing
B	3	3	Concrete thinking vs Abstract thinking
C	3	3	Affected by feelings vs Emotionally stable
E	3	3	Humble vs Assertive
F	3	3	Sober vs Happy-go-lucky
G	3	3	Expedient vs Conscientious
H	3	3	Shy vs Venturesome
I	3	3	Tough minded vs Tender minded
L	3	3	Trusting vs Suspicious
M	3	3	Practical vs Imaginative
N	3	3	Forthright vs Shrewd
O	3	3	Placid vs Apprehensive
Q_1	3	3	Conservative vs Experimenting
Q_2	3	3	Group-dependent vs Self Sufficient
Q_3	3	3	Undisciplined Self-Conflict vs Controlled
Q_4	3	3	Relaxed vs Tense

Item	Characters Reserved	Comment
Ohio State Psychological Examination		
Part I	6	Same-Opposite Section
Part II	6	Analogy Section
Part III	6	Reading Comprehension Section
Total	6	
Edwards Personal Preference Schedule		
1. Achievement	6	
2. Deference	6	
3. Order	6	
4. Exhibition	6	
5. Autonomy	6	
6. Affiliation	6	
7. Intraspection	6	
8. Succorance	6	
9. Dominance	6	
10. Abasement	6	
11. Nuturance	6	
12. Change	6	
13. Endurance	6	
14. Heterosexuality	6	
15. Aggression	6	

SAMPLE MODULE DATA RECORD

The module record is the basic record of the course file. In addition to data on presentation design data, the record will include data on test items and objectives unique to the module. Cross referencing for search requirements will also be used.

Item	Characters Reserved	Comment
Module I.D.	7	Char. 1 - Item Type: 2 = Module Data Char. 2 - Status: Several conditions could arise during development, processing, or revision that could require a status flag to be set. Char. 3-6 Serial I.D. Interrecord codification requirements should dictate a numbering system other than pure sequential. Char. 7 - Revision Number: The current version of the module should be updated and listed to avoid using erroneous material.
Stimulus Representation	3	Presently three options 1 = Pictorial 2 = Verbal - Spoken 3 = Verbal - Written However, these will probably be refined to include other categories and combinations.

Sample Module Data Record

Item	Characters Reserved	Comment
Response Demand	3	Presently four types 1 - Covert 2 - Overt - Written 3 - Overt - Vocal 4 - Overt - Selected
Management Frequency	3	Denotes the degree to which feedback or student responses alters the presentation. High, medium, low.
Response Demand Frequency	3	Denotes the frequency with which responses are demanded throughout the module. 1 - High 2 - Average 3 - Low or none
Stimulus Duration	3	Specifies the length of time the presentation remains intact. Presently a relative scale from transient to persistent. Might, however, become an actual time measure.
Management Type	3	There are generally three purposes: 1 - Repetition 2 - Multi-level 3 - Error - diagnostic

Sample Module Data Record

Item	Characters Reserved	Comment
Media	3	Present inventory code

a. videotaped lectures

b. audiotaped lectures with accompanying panelbooks

c. syndactic text (summary statement on concepts in text followed by frame sequence in text)

d. syndactic videotape (summary of concepts by videotape lecture followed by frame sequence in text)

e. syndactic slide-tape (summary of concepts of synchronized slides and audiotape followed by frame sequence in text)

f. lectcard (tape lecture and textual presentation)

g. computer assisted instruction (CAI)

h. linear programmed text (frame sequenced text)

i. multi-level text (summary sequenced, paragraph sequenced, and frame sequenced text)

j. films

k. group discussion

l. resource materials (Teaching-Learning Unit; traditional approach)

Sample Module Data Record

Item	Characters Reserved	Comment
Number of Objectives	3	Total number of terminal and enabling objectives within the modules
Cost	15	This item will probably be broken out to distinguish between development cost, operating cost, remediation cost, etc.
Decision Criteria	3	The assumption here is that this specifies the level of performance that triggers some type of management action. If so, it will be broken out.
Time Code	50	Research has specified that time is one of our more important variables. However, the collection of time data and its recordi ng has not been specified. This test run allows a single character for each student that will contain the following code. 0 - No time spent 1 - 5 min. or less 2 - 10 min. or less 3 - 15 min. or less 4 - 20 min. or less 5 - 25 min. or less 6 - 30 min. or less 7 - 35 min. or less 8 - 40 min. or less 9 - more than 40 min.

Sample Module Data Record

Item	Characters Reserved	Comment
Effectiveness Rating Total	12	Allowing two characters for summary data on student measurement of effectiveness across six possible categories 1 - Outstanding 2 - Excellent 3 - Very good 4 - Unsatisfactory 5 - Very poor 6 - Totally unacceptable
Objective I.D. (for each)	7	Char. 1 - Type of Item 3 - Behavioral Objective (Terminal or Enabling not distinguished here) Char. 2 - Status - Possible status conditions of an objective could be "unchanged," "revised," "Test results indicate problem." Char. 3-6 Serial I.D. The I.D.'s for Objectives, Test Items, etc., will be coded systematically to reflect logical relationships. Char. 7 - Revision or Objectives that have been recast or restructured should be noted with revision numbers.

THE DATA MANAGEMENT SYSTEM

After a thorough search of data management systems to meet the requirements of Project Annapolis, an IBM package, Generalized Information System (GIS) was chosen. It meets the contractor's flexible requirements for research and development, and promises to be a turn key package that will minimize operating difficulties when the course is turned over to the Academy at contract termination time.

For a benchmark at the IBM Data Center in Minneapolis, the following areas of the IBM Generalized Information System (GIS) were tested according to the test specifications developed for Project Annapolis. Generally, there were four major areas:

A - File Creation

B - File Inquiry

C - File Maintenance and Modification

D - Hold (Transaction) File Creation

The GIS proved to be a versatile data management system, operable under 360 Operating System (OS). Designed primarily as a user-oriented system, GIS provided the facilities for creating, maintaining and processing of data files for a variety of applications. A primary asset of GIS was its flexibility in supplying needed processing requirements in a dynamic environment.

GIS Performance and Capabilities to Meet Test Specifications

A. File Creation

In order to create a data set, it must first be defined. This is accomplished by setting up Data Description Tables (DDT's), which serve as logical symbolic information, allowing further access to the file without regard to its format or organization. A DDT must also be produced that will define the source from which the master file is created. A source DDT will, in most cases, be a duplication of relevant parts of the DDT for the master file. Identical name field from the source file are transferred to the master file during a create procedure. As an example, Figure 1 illustrates the DDT's that might be used to define a simple student master file (A) and its source file (B). One additional field the source file record requires is a GIS ID Field. For example, if a card file of one or more different formats is used to create a student master file, each type of card used must have at least one position with a character unique to that card type.

GIS provides for control over entering data by allowing edit specifications to be applied to a field. For example, in Figure 1-A, the Edit Value

(EEDVAL) for the field named ID, which has a length of four characters is "9999." This allows only a numeric character in any of the four positions.

In addition to the above example, the following optional controls may be applied as specified in the IBM System/360 Generalized Information System Application Description Manual, H20-0574-0. The application of these to the project is in the capability of flexible report formats without elaborate programming.

(1) Header specifies an output header or title for a field and is used for listing purposes. If none is provided, the user-supplied symbolic field name is used on the automatic output.

(2) Mask describes the output formatting of a field at presentation time (suppression of zeros, punctuation, comments, etc.).

(3) Security specifies the classification of the data contained in the field. It can be used to limit access to the data and/or to restrict the changing of the data.

(4) An Edit specification enables the user to specify validation criteria that a field value must meet for entry or storage in a file. It may involve composition, range or table checking, or a combination of these.

(a) A composition edit is specified by an edit picture, and includes such elements as field length and justification. The GIS edit picture capability makes use of content categories represented by a standard set of symbols.

Symbol	Category
B	Blank
Z	Uppercase alphabetic (A through Z)
A	Uppercase alphabetic or blank
T	Lowercase alphabetic (a through z)
L	Lowercase alphabetic or blank
9	Numeric (Ø through 9)
X	Uppercase alphabetic or numeric
.	Punctuation (period, comma, etc.)
S	Special (dollar sign, asterisks, etc.)
=	Mathematical (plus, minus, etc.)
C	Communications (line feed, end of transmission, etc.)
M	Any of the above.

Using the above sumbols, the edit picture "XTTT" signifies that the field data is a combination of four letters, with the first letter uppercase and the last three lowercase. The word "Rome" would pass the test, but "NASA" or "take" would not.

(b) A range edit specification defines the maxin um and minimum value that can be contained in the field.

(c) A table edit specification defines all values that a given field can contain or names an external table which defines the values.

In addition to the above edit options, the user may specify the name of his own specialized routine to edit a field.

(5) The conversion capability enables the user to specify either the name of a routine or an encode table (either internal or external) to be applied to data entering a field during an update. Each entry in the encode table consists of a valid input value for this field and a corresponding code value which will actually be placed in the field. Additionally, a user written routine, an internal decode table in the DDT, or an external decode table may be specified as being applicable to data being extracted from a field for presentation in the form of a report. Each entry in the decode table contains a coded field value and a corresponding "real" value to be used in place of the stored field value for presentation purposes.

Figure 1

A. Student Master File DDT

```
DDT;
FILE: NAME=STDNTMST, RCDLVL=H H H H H H H H H H H H H H H H H H H H H H;
FLD:NAME=NAME, LENGTH=16;
EDIT:TYPSPC=PICT, LGTHA=16, EEDVAL=ZAAAAAAAAAAAAAAA;
FLD:NAME=GRADE, LENGTH=2;
FLD=NAME=ID, LENGTH=4, HEADER=STUDENT I.D.;
EDIT:TYPSPC=PICT,LGTHA=4, EEDVAL=9999;
FLD:NAME=AGE, LENGTH=2;
EDIT:TYPSPC=PICT, LGTHS=2, EEDVAL=99;
EDIT:TYPSPC=RNGE, LGTHA=2, EEDVAL=17,20
SEGM:NAME=SMASTER, LEVEL=00, TYPE=RECORD, UNIND=Y, SORT=NAME, A;
DATM:DSORG=PS, SILOC=TRK, BLKSIZE=220, CATLG=NO,;
    #DSNAME=STUDENT.MASTER, INCRE=1, LRECL=22, RECFM=FB,;
    #RELEASE=YES, SPACE=5, UNIT=2314, VOLUME=SER=SDILIB;
END;
```

Figure 1

B. Student Source File DDT

```
DDT;
FILE:NAME=SSOURCE, RCDLVL=H H H H H H H H H H H H H H H H H H H H H H;
FLD:NAME=NAME, LENGTH=16;
FLD:NAME=GRADE, LENGTH=2;
FLD:NAME=ID, LENGTH=4; HEADER=I.D.;
FLD:NAME=AGE, LENGTH=2;
FLD:NAME=GISIDFLD, LENGTH=1;
SEGM:NAME=CARDS, LEVEL=00, TYPE=MULREC, OPTION=ID, IDVAL=S,;
    #OPTFNM=FISIDFLD, UNIND=Y,SORT=NAME,A;
DATM:DSORG=ILS;
END;
```

Once the format of the source and master files are determined, the next step can create the master file. The following illustrates the procedure that could be used to create the student master file defined in Figure 1-A.

```
CREATE STDNTMST FROM SSOURCE;
STRUCTURE SMASTER FROM CARDS;
INSERT SMASTER;
END PROCEDURE;
```

B. File Inquiry

Another major asset of GIS is the minimum programmer assistance needed to produce reports. The following illustrates all that would be needed to produce a report of all students with a grade classification of "2", from the master file defined in Figure 1.

```
QUERY STDNTMST;
LOCATE RECORD;
WHEN GRADE EQ '2';
LIST RECORD;
END PROCEDURE;
```

Although the above example is fairly simple, a GIS inquiry can become complex in nature involving a search based on several specific arguments in a cross-reference of up to 16 files.

C. File Maintenance and Modification

In most systems, there must be facilities for entering new data, deleting old or erroneous data and keeping file contents current. GIS provides capabilities allowing the user to add new information from source files and delete or alter old information. At update time, GIS can also provide an edit or monitor list of any conditions not meeting specifications.

For example, if we wanted to change all students in our master file described in Figure 1, who have a grade classification of "2" and an age greater than 23, to a grade classification of "7", the procedure might be as follows:

```
MODIFY STDNMST;
LOCATE RECORD;
WHEN GRADE EQ '2';
AND AGE GT '23';
```

```
CHANGE GRADE TO '7';
EXHAUST STDNMST;
END PROCEDURE;
```

In addition to the MODIFY mode, GIS also provides an UPDATE mode for entering new data from source files. An UPDATE procedure could be compared to a CREATE procedure, the latter being essentially an update of an empty file.

Since all data movement must meet the specifications in the Data Description Table, a high degree of accuracy is assured whether files are simple or complex.

D. Hold File Creation

There may be instances where a user would want to isolate certain students or information from his master files for use in subsequent specialized reports. GIS provides the capabilities to select data from master files and create hold or transaction files for use in subsequent runs.

Specifically, project research requirements could ask that selected student data be abstracted by stated criteria and be incorporated into a temporary transaction, or hold, file that must be processed by some standard package such as a sort or statistical subroutine. As an illustration, assume we want to create a hold file of all students in our master file with an item (grade) classification of "4" (which might represent class standing by quartile), then we want to sort the hold file in descending order and list it. The sample procedure, as follows, illustrates the simplicity of coding.

```
QUERY STDNTMST;
LOCATE RECORD;
IF GRADE EQ '4';
HOLD HOLDFL1 NAME, AGE, GRADE;
EXHAUST SMASTER;
SORT DES HOLDFL1  NAME;
QUERY HOLDFL1;
LOCATE RECORD;
LIST RECORD;
END PROCEDURE;
```

The Data Management System

Inclusion of User Written Subroutines

GIS provides the ability to include user written subroutines in a GIS procedure. There is a restriction in that no Input/Output operations are allowed in user subroutines. From experience gained in previous testing, it appears that the most effective way to meet specialized needs would be use of one of the high-level, general purpose languages such as COBOL, PL/1 or FORTRAN.

The following advantages of GIS relate to Project Annapolis:

(1) GIS files are standard 360 format and therefore available to programs written in other languages.

(2) Minimum training is needed for simple usage.

(3) GIS is economically feasible for use on low-volume or 'one shot' reports.

(4) GIS provides security controls to prevent access or modification of files.

(5) File formats can be changed without affecting GIS programs.

(6) GIS is operable in a minimum of 90K bytes of core storage.

The specific disadvantages of GIS will be more apparent after system implementation and experience. The following general ones relate to Project Annapolis.

(1) Due to its generalized nature, GIS is less efficient with regard to processing speed.

EVALUATION AND VALIDATION SUPPORT

The statistical subroutines that will be used in conjunction with Generalized Information System (GIS) for evaluation and validation of the course are catalogued here by area of applicability and by specific function.

Prior to the operation of the experimental course, data in the student base will be analyzed to meet specific requirements of the research design. One task will be the normalization of scores from the Ohio State Psychological Examination for the local population of the U.S. Naval Academy midshipmen. This will be accomplished through a cumulation frequency distribution analysis of the OSU scores. The second task will be the calculation of the predicted Point Grade Average for each student based on their entrance qualifying scores.

During the progress of the course, the test items on all tests will be subjected to item analysis routines that will establish item difficulty measures and item discrimination scales.

Student Scores on the course tests, along with the independent variables from the data base will be analyzed by multiple correlations routines, step wise regression routines, and tests for linearity of regression.

Evaluation and Validation Support

Programs are presently available for these routines, and they can interface with GIS in any desired combination.

COURSE PERFORMANCE ITEMS

The following items have been defined as the basic input/output items of the system.

Input Items

1 - Administrative Pretest

2 - Student Questionnaire (relative to prior experience with media learning)

3 - Progress Checks

4 - Student Time through module

5 - Student Preference

6 - Cumulative Post Test

7 - Administrative Mid Term Exam

8 - Administrative Final Exam

9 - Remediation Records and Scores

10 - Cost Data

Output Items

To Annapolis (USNA)

1 - Computer Generated Status Reports

2 - Computer Generated Prescription Report (tentative)

3 - Appropriate documents to satisfy USNA academic administration requirements.

Course Performance Items

Output Items (cont'd)

To Albuquerque (BSD)

1 - Cumulative Status Report (by student)

2 - Reports on Module Selection (by student)

3 - Reports on Student Performance (by module, by student)

4 - Reports on Module Achievement

5 - Item Analysis Reports

6 - Item Difficulty Reports

7 - Multiple - Regression Statistics Establishing Relationships between Student Characteristics and Performance.

Project Annapolis Systems Configuration

At Measurement Research Center, Iowa City, Iowa

OFF-LINE T/P EQUIPMENT:

Configuration A

1 1051 Control Unit
1 1052 Printer Keyboard
1 1056 Card Reader
1 1057 Card Punch

Configuration B

1 1051 Control Unit
1 1052 Printer Keyboard
1 1056 Card Reader
1 1057 Card Punch

Configuration C

1 1051 Control Unit
1 1052 Printer Keyboard
1 1056 Card Reader
1 1057 Card Punch
1 2956 Optional Card Reader

UNIT RECORD EQUIPMENT:

1 083 Sorter
1 085 Collator
1 557 Interpreter
1 519 Reproducer

INPUT SCANNING EQUIPMENT:

5 603 CDC Tape Drives
3 160 CDC 4K Computers
2 SCC 650 12K Computers
1 MRC Model 5 Sheet Scanner
1 MRC Model 6 Sheet Scanner
1 MRC Model 10 Sheet Scanner
1 MRC Model 11 Sheet Scanner
1 MRC Model 801 Card Scanner
1 MRC Model 1501 Card Scanner

IBM 360/40

No. of Units	Type	Feature Code	Description
1	2040	G	256K CPU
		3232	Decimal Arithmetic
		4427	Fltg. Point Arithmetic
		4457	1401 Compatibility
		6980	Sel Channel 1st.
		6981	Sel Channel 2nd.
		7520	Storage Protect
		7920	1052 Adapter
1	1052	7	Printer Keyboard
5	2401	2	Magnetic Tape Units 7TK
1	2410	2	Magnetic Tape Units 9TK
6	7160		Simultaneous Read While Write

Project Annapolis Systems Configuration
At Measurement Research Center, Iowa City, Iowa

No. of Units	Type	Feature Code	Description
1	1403	N01	Printer 1100 LPM TRAIN
		9043	Reg. Color Accent-Blue
		9905	230V AC 3PH 60 CY
1	2401	2	Magnetic Tape U-45K1
		9043	Regular Color Accent-Blue
		9053	Tape Reel-Blue
		9905	230V AC 3PH 60 CY
		9557	Read/Write Hood-7TK
2	2402		Magnetic Trade Unit
			No special features
1	2403	2	Mag Tape V & CON - 45KC
		9043	Reg. Color Accent-Blue
		9053	Tape Reel-Blue
		9955	230V AC 3PH 60 CY
		3328	Data Conv. 7-9, 9-7
		7125	7TK Compatibility
		9557	Read/Write Head-7TK
1	2501	B02	Card Reader
		8062	2501 Compat. Attach.
		9043	Reg. Color Accent-Blue
		9904	230V AC 1PH 60 CY
1	2520	B02	Card Punch
		8063	2520 Compat. Attach.
		9043	Reg. Color Accent-Blue
		9904	230V AC 1PH 60 CY
1	2821	002	Control Unit-1 1403
		3615	1100 LPM Printer
		9043	Reg. Color Accent-Blue
		9905	230V AC 3PH 60 CY
		9562	1100 LPM PR Adapter Control #1

Project Annapolis Systems Configuration
At Measurement Research Center, Iowa City, Iowa

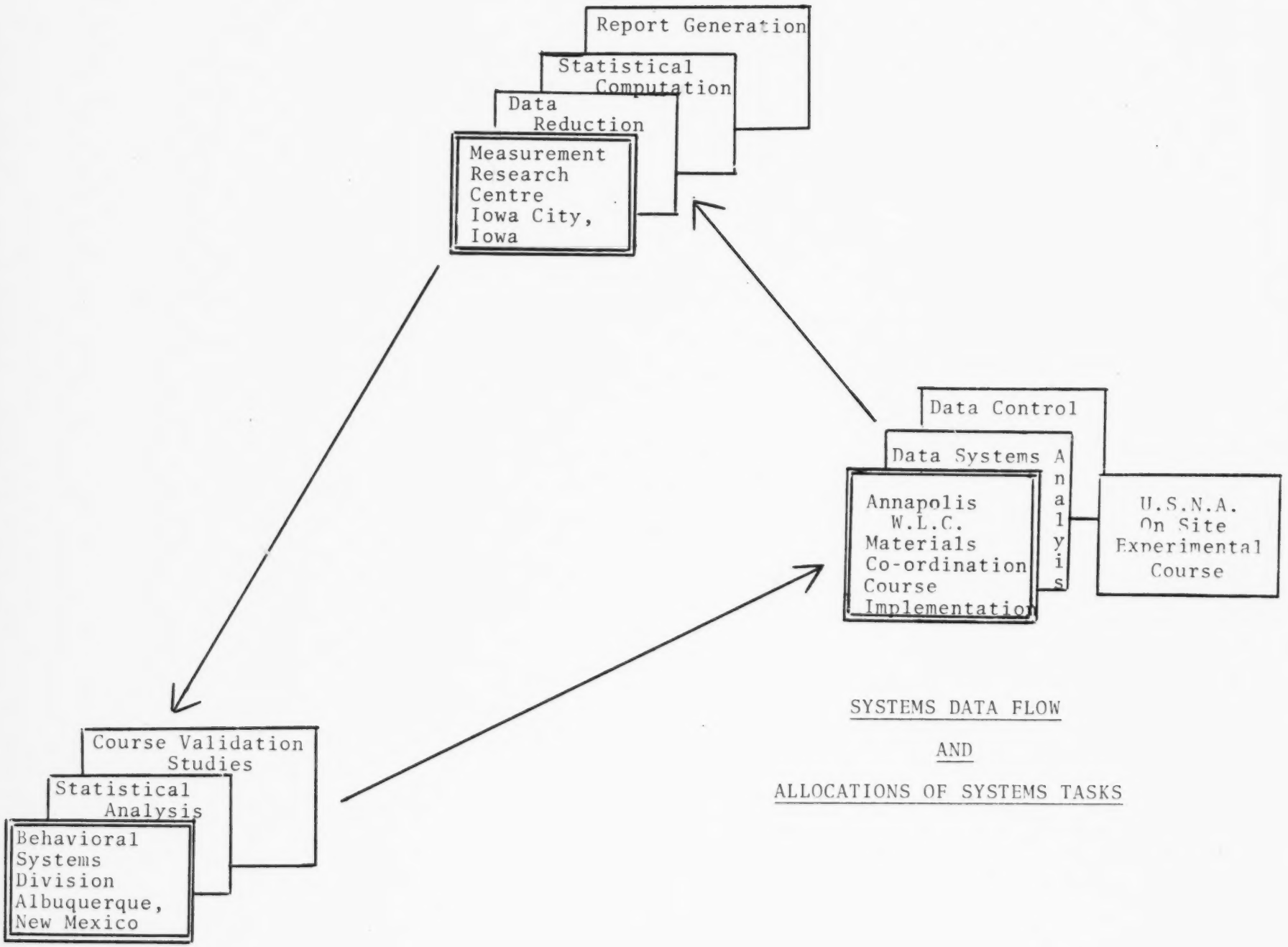
No. of Units	Type	Feature Code	Description
1	2804	1	Tape Control
		3236	Data Conversions
		7126	7TK Compatibility
	2841	1	Disk Control Unit
	2501	B1	Card Reader (600CPM)
4	2311	1	Disk Drives
1	1403	N1	110 LPM
IBM 360/30A			
1	2030	D00	CPU 16K 1.5 MS
		3237	Decimal Arithmetic
		6960	Selector Channel 1st.
		4456	1401/1440/1460 Compat-Basic
		4468	1401 Compat-Mag T on Sel. Chan.
		4463	1402/1403 Attachment
		5856	Programmed Mode SW
		7915	1051 Attachment
		1990	1401 Compat-Column Binary
		9043	Reg. Color Accent-Blue
		9905	230V AC 3PH 60 CY
1	1051	N01	Control Unit On-line & HME LP
		3130	Attachment CPU
		4409	First Printer Attach-MCL-N1
		4410	First Punch Attachment
		4411	First Reader Attachment
		9886	230V AC 1PH 60 CY Twist Lock
1	1052	006	Pointer Keyboard
		9104	Character Spacing 10/inch
		9435	Line Feeding 6 Lines/inch
		9571	Dual Case PR-EL - S/360 MOD 30
		9156	Line Space 6LPI Holes 9-318
		9509	Pin Feed Platen, Regular

Project Annapolis Systems Configuration
At Measurement Research Center, Iowa City, Iowa

IBM 360/30B

No. of Units	Type	Feature Code	Description
1	2030	D	16KCPU
		1990	Col. Binary
		3237	Dec. Arithmetic
		4456	1401 Compat.
		4463	1402/1403 Attach.
		4468	Mag. Tape Chan. Attach.
		5856	Prog. Mode SW
		6960	1st. Sel. Chan.
		7915	1051 Attachment
1	1051	N1	Console Printer Control
		3130	CPU Attachment
		4409	1st. Printer Attach.
		4410	1st. Punch Attach.
		4411	1st. Reader Attach.
1	1052	8	Console Printer
1	1403	N1	Printer 1100 LPM
1	1416-1	HN2	Printer Cartridge
4	2401	2	Mag. Tape Drive 7-TK
1	2821	2	Control Unit
		3615	1100 LPM Attach.
1	2803	1	Mag. Tape Control
		3228	Data Conversion
		7125	7 Track Compat.
1	2501	B2	Card Reader
1	2520	B3	Card Punch
		1531	Card Image

APPENDIX

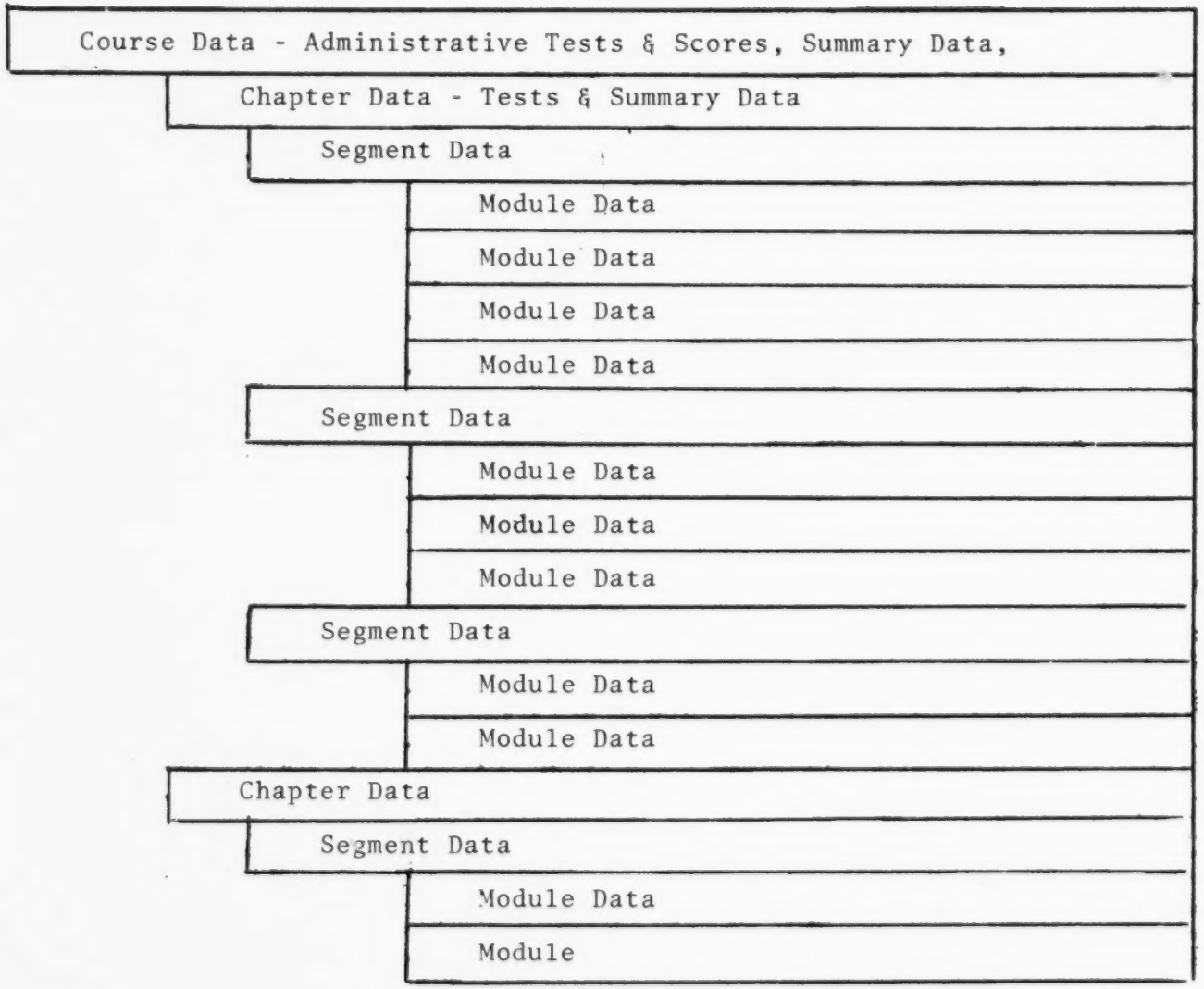


SYSTEMS DATA FLOW

AND

ALLOCATIONS OF SYSTEMS TASKS

ORGANIZATIONAL HIERARCHY OF COURSE FILE



PROJECT ANNAPOLIS

DATA SYSTEM